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Hydrogenerator Rotor Rehabilitation Methods

In this paper are presented the hydrogenerator rotor rehabilitation methods, stator forming the followings subassemblies: rotor, shaft, rotor bracket, rotor rim, rotor poles, rotor winding, rotor connections, and fans. The rotor rehabilitation are executed after the guaranteed time established by supplier firms or if in function time was appear different defects, defects that can out in function of hydrogenerator. Rotor rehabilitation can be made through changing rotor subassemblies parts or through by replacement existent subassemblies with new subassemblies compatible with existing hydrogenerator.

1. Introduction

The rotor rehabilitation are executed after the guaranteed time established by supplier firms or if in function time was appear different defects, defects that can out in function of hydrogenerator.

The components of rotor hydrogenerator are:

- Shaft
- Rotor rim
- Rotor bracket
- Rotor poles
- Rotor winding
- Rotor terminals
- Fans

The main defects that will be appear in function of hydrogenerator rotor are the followings:

- The poles have the friction on the polar shoe
- Difficult at rotor winding maintenance because of connections between coils

- Insulation burning at pole body
- Rotor winding defects as a result of thermal, mechanical and electrical effects

- Connection defects at damping winding
- Rotor core deformation owing to high vibration level
- Fissures in shaft

This defects are major defects which going out the damage of hydrogenerator. For this defects are removed, to impose the rotor rehabilitation.

Rotor rehabilitation can be make through changing rotor subassemblies parts or through by replacement existent subassemblies with new subassemblies compatible with hydrogenerator.

In figure 1 is presented an completely assembled rotor.

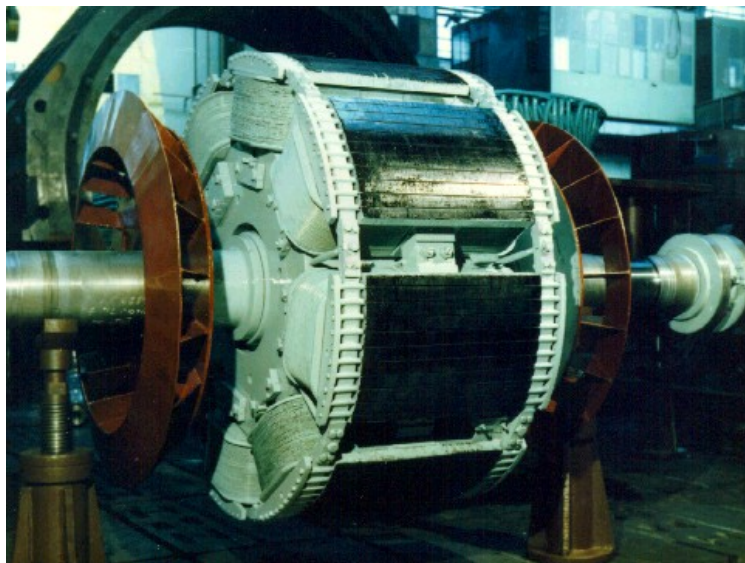


Figure 1. Completely assembled rotor

2. Contents of paper

2.1. Shaft rehabilitation

At generators, usually, the shaft is rehabilitation, thus:

- Rectification of radial bearing hub surface
- Checking of flange zone
- Rectification of coupling surface with rotor bracket
- Coated protections

The shaft may be completely new if he is very fissured.

These fissures appear when the maximum runaway speed is exceeded the computed value. This is specific at generators trained by Kaplan turbine.

2.2. Rotor bracket rehabilitation

The rotor bracket rehabilitation propose the followings operations:

- Visual inspection and nondestructive control
- The plane restoration of braking disk and mounting with replacement of assemblies parts
- Cleaning and coated protections

2.3. Rotor rim rehabilitation

The rotor rim will be rehabilitated thus:

- Restoration of wedges at hot of rotor rim on the rotor bracket with replacing taper wedges
- Restoration clamping and assurance of rotor rim screw nuts
- Checking the pole fixing ducts
- Restoration vertical of rotor rim polygon – if case
- Cleaning and coated protections

2.4. Rotor poles and rotor winding

In figure 2 is presented rotor pole completely wound and in figure 3 is presented rotor winding.

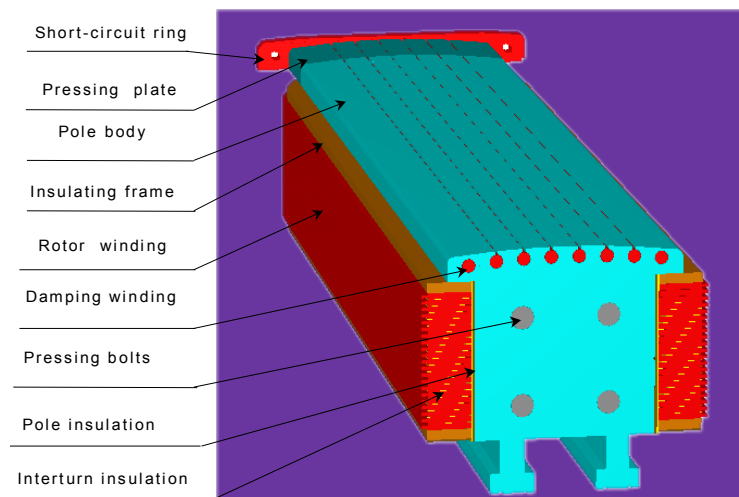


Figure 2. Rotor pole completely wound

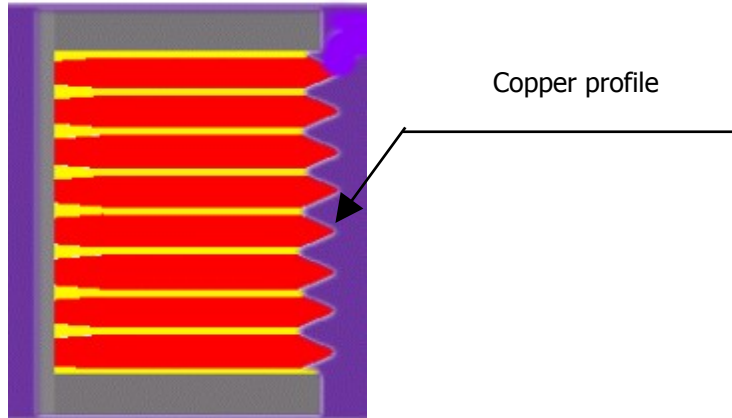


Figure 3. Rotor winding

The rotor poles and rotor winding rehabilitation consist in:

- Dismantling of rotor coils
- Cleaning and washing of pole body
- Restoration of insulation at pole body and of the connections from damping winding bars
- Cleaning of rotor coils, elimination the existent insulation between coils spire and cutting the actual connections between coils
- Execution a new connection between coils. The connections in upper parts of rotor will be removed and these make in dismantling solution with screws and consolidation on the rotor rim
- Restoration insulation between coils with NOMEX

In table 1 is shows the actual solution in comparison with the new solution for winding insulation rehabilitation for rotor winding.

Table 1.

Characteristics	Actual solution	Rehabilitation solution
Material	Asbestos	NOMEX
Insulation weight [mm]	0.4	0.28
Dielectrically rigidity [kV/mm]	7	16
Maximum admissible pressure [kg/cm ²]	200	450
Insulation class	F	H
Bending stress [N/cm]	30	300
Thermal conductivity [W/m ^o K]	0.01	0.12
Drying time from 100 % at 50 % [min.]	1000	100

From the table 1 will be observe that the used new materials (NOMEX) have the high thermal, mechanical and electrical properties in comparison with the actual material.

- Executed the new frame of sticlotextolite material type
- Remounting coils on the pole
- Electrical tests
- Constructive modification of damping coils connections and replacement of assembling pieces

In function of degradation grade of poles and of winding, these may be new subassemblies, optimally designed, and used the materials with high mechanical, thermal and electrical properties.

2.5. Rotor connections

The main rehabilitation works for these are:

- Dismantling the connections
- Restoration of defect zones
- Insulation of rotor connections with a new materials
- Replacement of consolidation elements
- Mounting and electrical tests

2.6. Fans

The fans will be rehabilitation thus:

- Constructive modification of upper support fans for correlation with electrical connections between poles
- Replacement the all fixing elements of fans on the rotor rim
- Coated protections

If these elements are new subassemblies they will be optimally dimensioning for assurance the cooling air flow necessary for generator and a high efficiency.

3. Conclusion

The guaranteed period for a hydrogenerator is maximum 20 years. In this time, because of different defects, defects that can out in function of hydrogenerator, the rotor hydrogenerator must be rehabilitation. The rotor rehabilitation has a lower cost and have necessary a short time of work.

References

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